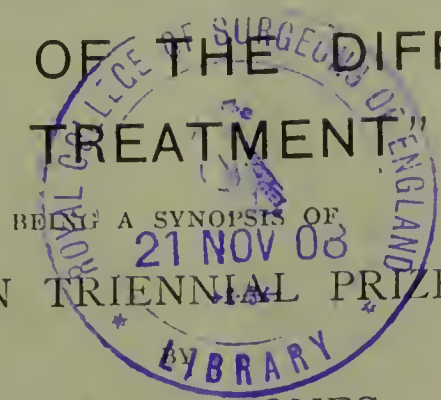


Oct-Nov 1908

"COLLES'S FRACTURE, WITH SPECIAL REFERENCE TO THE RESULTS OF THE DIFFERENT MODES OF TREATMENT"

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BEING A SYNOPSIS OF
THE HUTCHINSON TRIENNIAL PRIZE ESSAY, 1908,

H. EMLYN JONES

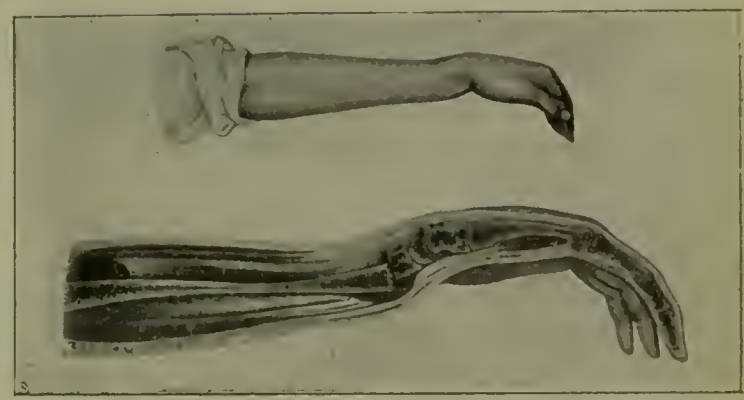
PART I.

After introducing and defining the subject, the author proceeds to give an outline of the history of Colles's Fracture from the time it was first described by Pouteau in 1783 until the present time.

The following writers' works and opinions were discussed at length:—

1. Pouteau (1783).
2. Colles (1819), who really published the first decent account of the fracture.
3. Dupuytren (1820), who, by a post-mortem examination, showed the real character of the injury.
4. Voillemier (1842), who held this fracture to be always one of penetration.
5. Smith (1847), who opposed Voillemier's views.
6. Bennett (1879), who, from many recent dissections, first advocated the view that both "impaction" and "non-impaction" may occur.

The author then proceeds to show how in recent years, chiefly by the aid of radiography, we have ample proof that the simple transverse fracture without impaction, the impacted, and the fracture with the shattered lower fragment, together with many greater or lesser complications, may occur. The Röntgen rays have added more to our knowledge of the details of the injury than any other means, showing that the surface of the fracture is rarely flat and transverse, that comminution or splitting of the lower fragment is frequent, and especially that the displacement backwards of this fragment is not nearly so commonly marked as one would suppose from the general appearance of the wrist.



The typical deformity and position of fragments in a Colles's Fracture, showing the most common displacement met with.

[After "Helferich." Ed. by J. Hutchinson, Junr.]

Regarding the mechanism by which the fracture is produced, three chief theories have been advanced:—

- (1) Fracture by splitting or crushing; the cancellous tissue is crushed or comminuted between the carpus and the diaphysis.
- (2) Fracture, as in other bones, by resolution of the force and yielding at the weakest point.
- (3) Fracture by cross-strain exerted through the anterior ligament in exaggerated and forced hyper-extension of the hand.

In 1 the weight of the body is received upon the ball of the hand, in the line of the long axis of the radius, the inner end of the scaphoid or the semi-lunar splits the end of the radius like a wedge. This is seen in many cases, and appears to be the more frequent in the elderly.

In 2 the arm is outstretched, but not directly in the line of the fall. Part of the force is taken up by the resistance of the shaft in the long axis, and part acting transversely to break the bone. The backward displacement and tilting of the lower fragment indicate the direction of this latter force.

The third theory is chiefly the result of experimental evidence on the dead body, and there is but little clinical evidence to support it. Without doubt most, if not all, of these fractures are produced by either the first or second methods.

In the *Lancet* of March, 1907, Dr. Morton gave a radiographic survey of 170 skiagrams clinically diagnosed as Colles's Fracture. These were the cases so admitted to the Out-Patient Department during the year 1906. In the following analysis I collected, first of all, the cases sent to the Radiographic Department definitely diagnosed as Colles's Fracture, and also those cases sent down from the Receiving Room as "Injuries to Wrist," from November, 1906, to January, 1908—a period extending over 15 months. Naturally, in some of these no fracture existed, and were simply sprains, but, after separating these out, it was surprising that in the large majority of such injuries definite fractures were present, and of these 158 could, without doubt, be called Colles's Fractures.

The analysis was as follows:—

- (A) The distance of the middle of the upper end of the lower fragment from the carpal border was:—

One-eighth of an inch...	...	in 1 case.
One-quarter of an inch	...	in 2 cases.
Three-eighths of an inch	...	in 47 cases.
Half an inch...	...	in 67 cases.
Five-eighths of an inch	...	in 20 cases.
Three-quarters of an inch	...	in 12 cases.
Seven-eighths of an inch	...	in 2 cases.
One inch...	...	in 1 case.

N.B.—The six others were fracture of the styloid of the radius into joint.

- (B) *The line of the fracture was:*—

Transverse	...	in 46 cases.
Irregularly transverse (<i>i.e.</i> , transverse, but line of fracture somewhat irregular)	...	in 75 cases.
Irregular	...	in 13 cases.
Oblique	...	in 7 cases.

- (C) *Variety of fracture:*—

A simple fracture of radius, without impaction or comminution, occurred	...	in 9 cases.
Impaction without comminution occurred	...	in 56 cases.
Comminution with impaction occurred	...	in 74 cases.
Comminution without impaction occurred	...	in 19 cases.

- (D) *The styloid process of the ulna* was fractured in 98 cases, and of these 98 it occurred as follows:—

Fracture of styloid process in cases of comminution without impaction	...	8
Fracture of styloid process in cases of comminution and impaction	...	53
Fracture of styloid process in cases of impaction without comminution	...	34
Fracture of styloid process in cases without either impaction or comminution	...	3

The fracture of the styloid process of the ulna occurred in 4 cases in which there was no other fracture.

- (E) *Displacement:*—

Backwards was present...	...	in 22 cases.
Backwards and slightly outwards, or markedly outwards	...	in 35 cases.
Backwards and inwards	...	in 6 cases.
Directly outwards	...	in 7 cases.
Directly inwards	...	in 1 case.

In no case of my 158 was there any displacement forwards, and in 81 the displacement was so slight as to be negligible. If it occurred at all in any of these it was very slightly backwards.

- (F) *Complications:*—

Splitting of the radius was present in 7 cases. Dislocation of the wrist, together with fracture, 2 cases. The fracture extended into the joint in 23 cases.

Considering these tables more minutely, several important points are brought out. In connection with the distance of the line of fracture from the carpal border it will be seen that in the large majority it is from three-eighths to five-eighths of an inch, and in only one of my cases did it reach one inch, and in no case at all did it exceed that distance. Although the distance that Colles described the fracture in his original paper was one and a half inches, it has long been known to be too great, but in no other analysis that I could find were there such a percentage occurring between the distances quoted. Regarding the line of fracture, in the large majority it was either transverse or transversely irregular; that is to say, the line was in the transverse direction in relation to the long axis of the bone, but was irregular in outline.

In table C. it will be seen that in almost every case comminution or impaction, or both, were present. Each case showing the radius consisting of more than the two fragments was taken as representing the presence of comminution, though oftentimes, of course, much greater comminution

occurred than one would think from an examination of the patient. Some impaction, the amount probably varying with the violence of the accident or blow causing the injury, occurred in most of the cases, and here again, in many, an examination of the patient before reduction did not suggest that impaction was present.

Consequently, though the fact that fracture without impaction can and does occur has been proved, both by dissections and by radiography, the views of some of the older writers that these fractures were all "fractures of penetration" was not held without a good deal of ground. Comminution without impaction is also a rare condition, but this is to be expected. In almost half the cases the two conditions were present together and seemed to work "conjunctly" as it were; fractures in which the violence was great enough to produce impaction being also comminuted by that same violence, and the latter still further aided by the "penetrating fragment" splintering to some extent the "penetrated fragment." The usual displacement is backwards and often slightly outwards, sometimes markedly so, but the forward displacement described by some authorities did not occur in any of the series, and the inward displacement in but one.

It is a remarkable fact that so little displacement is present in many cases, and even in a large number, which clinically one would expect marked displacement. On examination of a skiagram taken before any reduction has been attempted, very little, if any, is really present. Even in some of those cases in which the violence was great enough to cause comminution, little or no displacement occurred. This fact is perhaps one of the chief that radiography has added to our knowledge of Colles's Fracture. All the usual complications described were present in certain of the 158 cases, the most common, naturally, being fracture of the styloid process of the ulna. This was present in 98 of the 158 cases, and, from reference to Table D, it will be seen that this most frequently happened in those in which either comminution or impaction, or both, took place, though it occasionally occurred in those in which neither these nor marked displacement were present. In 4 cases (none of which are included in the 158 above) the styloid process of the ulna alone was fractured, and in one true Colles's Fracture the styloid of the ulna was comminuted (Case D, Appendix).

Splitting of the radius occurred in a marked degree in 7 of the series, and probably to a less extent in others, but this complication is on the whole a rare one (an example is seen in case F, Appendix).

Dislocation of the wrist was present in but 2, and in Colles's injury is very rare (case I, Appendix).

Such injuries as fracture of the radius high up, or fracture of both bones of the forearm, are excluded in the above series, as not representing the accident described by Colles.

The fracture extended into the wrist-joint in 23 cases, and of these 5 were typically Y shaped. 6 others consisted of fracture of the styloid process of the radius, the fracture extending obliquely into joint. A large triangular portion of the bone is broken off with but little displacement. This variety of the injury is probably much more common than has hitherto been thought, and excellent examples of both varieties are given in the Appendix (cases 2 and 8).

SIGNS AND SYMPTOMS OF COLLES'S FRACTURE

These, as a rule, are quite characteristic, although crepitus and abnormal mobility, which are so common in most fractures, are not always easily recognizable in this. There may be no deformity, but when displacement is maintained, the "silver dinner fork position," so aptly described by Velpeau, is almost sufficient to diagnose the condition. When viewed from the radial aspect, the hand and fingers are generally flexed, and the outlines of the wrist irregular. At the flexion fold there is usually a depression, and above this a prominence—the lower end of the upper fragment; on the dorsal aspect, opposite the prominence, is a depression due to the displacement backwards of the lower fragment, and lower down a prominence formed by the lower fragment and the carpal bones flexed upon it. From a study of many radiographs it is seen that there is often but little displacement of the fragments, even when clinically there is a good deal of deformity. Consequently one must look for other reasons beside the abnormal position of bones to produce this deformity, and there is now no doubt that in many cases most of it, on the dorsal aspect, is caused by swelling of the soft parts, aided to some extent perhaps by the even projection of the first row of carpal bones, and on the palmar aspect mainly by swelling of the soft parts. It must be well understood, however, in those cases in which marked displacement of the fragments is seen in the skiagrams, that then the bones themselves play a large part in the production of the deformity.

In some cases if the positions of the styloid processes (by pressing the end of a finger into the side of the joint below and against the end of each) be marked, it will be oftentimes found that the styloid process of the radius has risen, so that, instead of being a little nearer the hand than that to the ulna, it is now on the same level, or even above it.

The swelling upon the anterior surface of the forearm is quite marked, and is sharply rounded

off toward the wrist with deepening of the transverse creases. Occasionally crepitus and abnormal mobility can be obtained by grasping the lower fragment between the thumb and fingers and then moving backwards and forwards, at the same time steadying the forearm by means of the other hand. Pain is easily caused by pressure of the hand upward against the forearm, or by pressure along the line of fracture on the dorsal aspect of the bone. In fat people and children without much displacement, these manipulations may materially aid the diagnosis.

THE DIAGNOSIS OF COLLES'S FRACTURE

The following conditions and injuries are those from which the fracture has to be distinguished:—

- (1) A sprain or contusion of the wrist.
- (2) Separation of the lower radial epiphysis.
- (3) Fracture in the lower fourth of the forearm, with marked bending of the bones.
- (4) Dorsal dislocation of the lower radio-ulnar joint.
- (5) Dislocation of the hand at the radio-carpal joint.
- (6) Dorsal dislocation of the metacarpus.

(1) *A sprain or contusion of the wrist.*

This is more likely to be mistaken for a fracture if the limb has been broken previously, and has united with deformity, for it will present some of the functional and physical signs. The question, therefore, should be always asked whether the wrist has suffered a previous injury. Needless to say, in all cases of doubt a skiagram should be taken, and this will at once settle the real nature of the injury.

(2) *Separation of the lower radial epiphysis.*

The epiphysis at the lower end of the radius begins to ossify at two years, and joins about the 20th–22nd year; consequently this accident may occur at any age up to twenty, though it is usually in patients over ten. The causes and signs are much the same as those of Colles's Fracture, except that the lower end of the shaft of the bone projects with greater sharpness, forming an angle of 90° to 100°, whereas in Colles's Fracture the corresponding angle is 140° or more (Hutchinson). Occasionally this accident has been found to be compound. The diagnosis from a Colles's Fracture rests chiefly on the age of the patient (though a Colles's Fracture may occur in young people), on the character of the crepitus, and on the acuteness of the angle above mentioned. Both accidents can be distinguished from dislocation back of the wrist by the normal relation which the radial styloid process bears to the carpus, and by the absence of any resemblance in form between the prominences on the front and back of the wrist to the concave smooth lower edge of the radius, and the rounded convexity of the carpus.

Bad results not uncommonly follow this accident from arrest of development of the radius, which may be so considerable as to necessitate removal of a portion of the lower end of the ulna in order to prevent the deviation of hand to the radial side.

Dislocation of the lower radio-ulnar joint.

Though the joint is so frequently exposed to injury and is guarded by weak ligaments, this injury is a rare one. The lower end of the ulna may be displaced backwards in a fall or from forced pronation, or forwards, again in a fall or from supination. Helferich describes a subluxation of the joint in washerwomen, which, he says, arises from the rotatory movements used in washing clothes.

Dislocation of the hand at the radio-carpal joint.

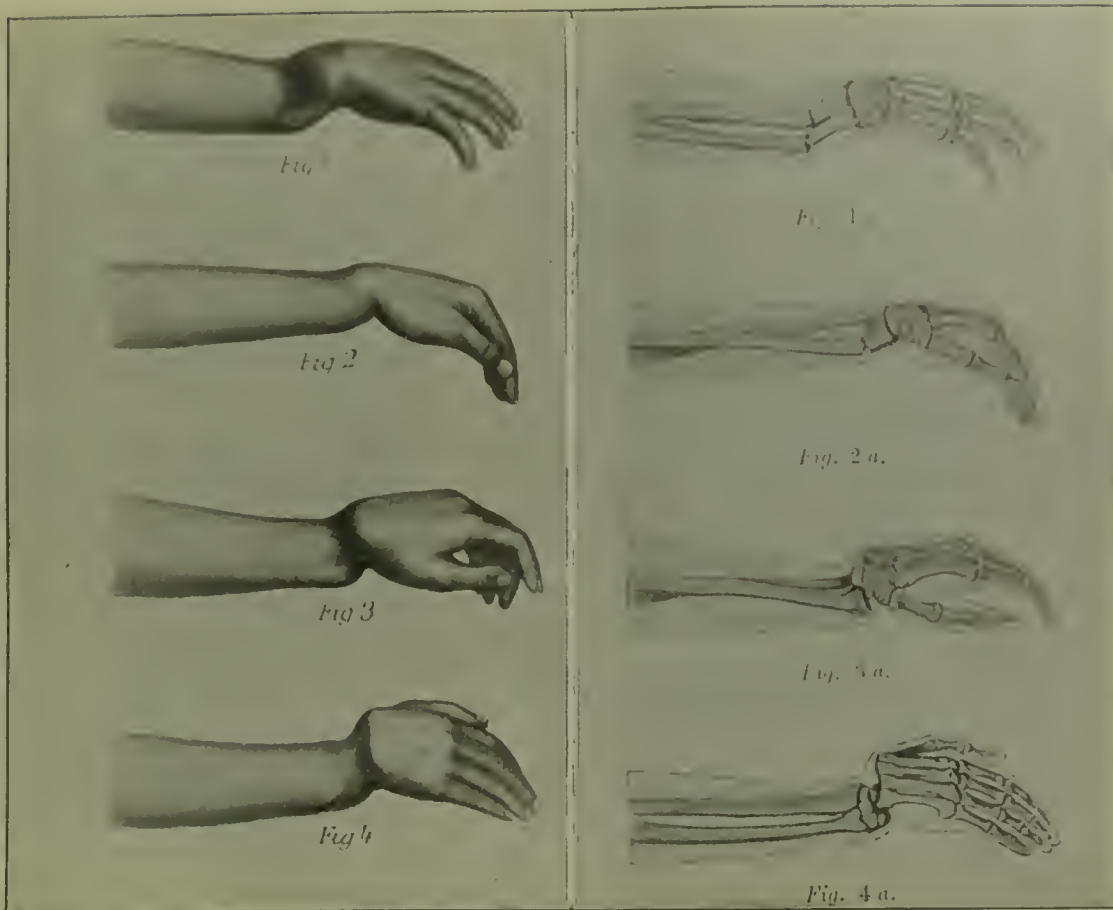
This is also a rare injury, and in several instances has been found to be merely a complication of Colles's Fracture. It is due to a fall on the outstretched hand, the latter being strongly bent forwards or backwards at the time, with the result that the carpus was displaced backwards or forwards as the case might be. In the accompanying photograph (taken from Helferich) are seen the deformities illustrating these various injuries about the wrist-joint, and also the relative position of the bones giving rise to much deformity.

COURSE AND PROGNOSIS OF COLLES'S FRACTURE

With suitable treatment, firm union between the fragments is usual in about 4–5 weeks. Non-union seldom occurs (in my series there was no such case), though Cheyne suggests that sometimes this may happen, either because the fracture has never been reduced or because reduction has been imperfect. In the few cases here in which reduction was not attempted perfect union resulted. (Case 13, Appendix).

Regarding deformity the prognosis depends on the treatment, and some say upon the completeness of the reduction and retention. In young subjects permanent deformity is the exception, and is present very slightly, but in older folk such deformity may persist, either because of great displacement or in some cases in which crushing and comminution has been so great as to make complete reduction and retention impossible. The persistence of marked displacement, however, does not necessarily cause disability, and such may exist and still wide range of motion with painless and fairly free movement be present.

After immobilization some rigidity of wrist may occur for a few weeks, and to some slight extent of the fingers, but with proper treatment this should be slight and of short duration. In old rheumatic subjects, especially where there has been a good deal of inflammation of the tendon sheaths, the case is different, and it then is very questionable if splints and immobilization should be resorted to at all.



Figs. 1 and 1A. Fracture of both bones of the forearm, with backward bending of the bones.
 „ 2 „ 2A. Colles's Fracture.
 „ 3 „ 3A. Dorsal dislocation of the carpus.
 „ 4 „ 4A. Dorsal dislocation of the metacarpus. } Very rare injuries.

[After "Helferich." Ed. by J. Hutchinson, Junr.]

If rigidity of the fingers occurs it is due to the immobilization, possibly together with some inflammation of the sheaths, but in those cases where passive movements and massage are applied at the earliest opportunity this complication will cause but little trouble.

From a reference to Colles's original description of the injury, it will be seen that in many of the so-called or so-diagnosed sprained wrists he examined he was able, by a certain amount of traction, to produce movement at the site of the injury, and so came to the conclusion that in many of these cases the bones were broken and the injury was not really a simple sprain.

From this time on much more care was taken in the exact diagnosis in the individual cases, viz., whether fracture or sprain, and consequently the treatment of the fracture by immobilization by means of splints came into general use. In many cases however, right up to the present time, notwithstanding this immobilization, much deformity oftentimes resulted, and even the loss of power to a considerable extent both of the wrist and of the

fingers. Flexion and extension of the fingers the same movements, together with adduction and abduction, and to some extent also pronation and supination of the wrist, often are extremely badly performed for a temporary period following, and even permanently, causing thereby great inconvenience to the patient, and maybe preventing him from continuing his occupation.

Before this treatment by splints was adopted, deformity certainly used to be, on the average, as great or greater, but movements were usually fairly perfect, except of course in those cases (though often undiagnosed) in which comminution was great. So far is this true that some have even suggested that Colles's discovery has been a misfortune for many of the sufferers of this injury, saying that if you simply place the injured arm on a cushion without pressure or deformity, and encouraging use at the end of a week, a far better average of results would be obtained than by the regular method of immobilization by splints, and they go still further and say that the discovery led to measures of treatment not only useless but injurious.

Consequently two distinct views were taken by authorities as to the treatment which should be adopted, and these two views are still held up to the present day: one class, including Colles, Cline, Beck and others, advocating the reduction of the fracture, or at least an attempt at its reduction, followed by immobilization at an early date, the other class still maintaining the better way is to treat the injury as a sprain, thus resting it for a week without splints, and early encouragement of the use both of the fingers and wrist.

Those of the latter class, who abstained from attempts at reduction in the majority of cases, base their views according to Mr. Hutchinson, Senr., on the following arguments:—

- (1) That the displacement which is present results directly from the direction of force at the time of the accident, and not in any material degree from the action of muscles, as was at first considered to be the case.
- (2) That the bone at the site of fracture being much expanded, the exposed surfaces are large and do not easily move one upon the other.
- (3) That, in addition to the immobility which the apposition of large surfaces necessarily implies, there is often very definite fixation by impaction, the end of the shaft being driven into the carpal fragment.
- (4) That the carpal fragment being very short, and susceptible of movement only by dragging on the attached ligaments, etc., or by direct pressure, it is usually very difficult, if not impossible, to move it.
- (5) That it is quite possible, by traction, to effect apparent removal of deformity without having really altered the relative positions of the broken fragments in the least. Thus the hand may be carried over the ulnar side, and thus the projection of the ulna concealed.

- (6) That it is but seldom either mobility or crepitus at the site of the injury can be detected.
- (7) That the locking of the fragments together is often such that the patient can, from the first, lift the limb and allow of pronation and supination to a certain extent without material pain.
- (8) That the locking of the fragments is usually such that it prevents any risk of subsequent increase of displacement, and thus renders the use of apparatus of immobilization wholly unnecessary.

From these arguments one may see the advocates of this view hold that reduction is generally impracticable, and immobilization unnecessary. Nevertheless, in the few cases in which deformity is extreme and displacement considerable, they then suggest that it should be ascertained, by traction in a straight line, whether there is any movement at the site of fracture, and whether it is possible to obtain any better position. If so, they agree that this should be done, and then the "reduced" injury treated as a sprain without splints, and movements encouraged from the beginning. Thus they believe that, if the lower fragment can be moved and brought more nearly end to end with the upper one, the largeness of the surfaces in apposition will usually suffice to prevent renewal of the displacement. Again, a few of this class go still further and state that if any tendency to such renewal is manifested, an immobilizing apparatus (*e.g.* splint or plaster case) should be resorted to, otherwise it is not needed and usually injurious.

They oppose any attempt to exert permanent traction on the fragments, or to press them into position by pads. Such expedients are, they say, not only useless, but liable to injure the tendons and soft parts which are made to bear the pressure.

They hold that a slight disfigurement exists or persists, but is of no consequence whatever as regards the use of the limb, and, on the other hand, the restoration to use is rapid and without any stiffness of the fingers and wrist.

1.

1A.



2.

2A.

1 and 1A. (Case F Appendix). Partial Colles's Fracture, with splitting of shaft of radius.
 2 and 2A. (Case 3 „). Impacted Fracture, with marked comminution.



PART II.

The author opened the second part of the subject by outlining the views of other leading authorities, including those of Cline, Bond, Smith and Gordon, Carl Beck, and last, but not least, the writings of Helferich were fully reviewed. The latter's methods of attempting reduction were described, and his methods of after-treatment compared with all other generally adopted methods, viz., those of Schede, Strop, Stimson, Carr, Treves, etc. The Pistol splint and the splint recommended by Gordon were condemned on the ground that with their use the fingers are kept in a far too restrained position.

Mr. Jonathan Hutchinson, Senr., in his review of this subject in the New Sydenham Society Atlas, makes the following statements and asks the following questions:—

- (1) Whether any real alteration in the relative position of the fragments is in the majority of cases affected by manipulation. Probably some in cases of great deformity.
- (2) Having ascertained that this had been effected, it would next be good to know whether when extension is relaxed there is any tendency to reproduction of displacement.

With the idea of answering these points, in the year 1907 I took twelve cases selected at random from the 158 analysed in a previous section.

A radiograph was always taken before any treatment was adopted, and in these cases I took another radiograph at some period subsequently. Following on these, ten cases (consecutive as far as possible) were taken, which were carefully watched all through, radiographs being taken on three occasions, before treatment, again after two to three weeks, and, finally, from two to three months after the accident.

In the first series of twelve cases:—

Attempted reduction was performed in cases 2, 3, 4, 5, 6, 7, 10 and 12.

In cases 2, 3, 4, 5, 7 and 12, a second radiograph shows that no alteration whatever in the position of the fragments had been effected by the manipulation, and that reduction was not really performed at all; the apparent reduction probably being due to an alteration in the soft parts on application of extension.

In case 6, a complete reduction was said to have been effected, but a second radiograph shows that

there was not much alteration in the final position of the fragments. The displacement must have partially, if not wholly, returned on relaxation of extension.

In case 10, a case of impacted fracture with very marked outward displacement in a man *æt.* 73, improvement in position was certainly obtained, though, here again, perfect reduction was said to have been effected, and yet still some extensive deformity remained.

Reduction was not attempted in the remainder of these twelve cases, viz., 1, 8, 9 and 11, in all of which cases just as good permanent results were obtained.

In the second series of ten cases (as far as possible consecutive cases coming to Hospital and seen in the Receiving Room):—

Reduction was attempted in cases 14, 15, 16, 17, 20, 21 and 22. In all of these (excluding case 16) no alteration or improvement in the position of the fragments was obtained. This is well seen by a comparison of the series of radiographs in the Appendix. Case 16 was a fracture of the shaft of the radius quite one inch from commencement of carpal enlargement in a lad *æt.* 14. This boy had also separated his ulna epiphysis, with displacement of the latter, and the second radiograph of the case shows that this displacement was permanently rectified by reduction.

Thus, taking the two series together, attempted reduction was performed in fourteen cases, and in twelve of these the attempt proved futile. In the two others with marked displacement some improvement was obtained, but nothing like the improvement one would have expected from the statement of the Senior Dresser "that reduction was absolute," and from a clinical view of the case when extension was being performed. Notwithstanding attempts to maintain this good position by means of splints, a good deal of the deformity undoubtedly returned on relaxation of extension.

Several cases were screened under the X-rays whilst attempts at reduction were made, and though, clinically, some of the deformity disappeared, as far as could be seen no alteration was made in the position of the fragments. This method of observation, recommended by Mr. Hutchinson, Senr., is far more difficult to draw conclusions from than one would expect, the difficulty lying in the fact that very slight alteration in the positions of the bones could be made without such alterations be obvious to the onlooker.

However, these results undoubtedly prove the truth of Mr. Hutchinson's observations, and one may say that in the large majority of cases when impaction is present, no alteration is made in the position of the fragment by attempting reduction. In a few of great deformity an improvement may be effected, and though a certain portion of this improvement may be permanent, most of the displacement returns on the relaxation of extension. If attempt at reduction is made, and the Surgeon thinks to some extent successfully, splints must be used to maintain this position; but, as a rule, just as much permanent deformity remains in these cases as in those in which reduction is *not* attempted; and, certainly, if splints are used, especially in patients over 50, though ultimately a fair result may be obtained, a much longer period of time is necessary for this result than in those cases in which neither reduction is attempted nor splints applied.

In cases 4 and 5 of the first series, and cases 15, 17 and 21 of the second series, reduction was attempted under anæsthesia, but the result was the same, for in none was any material alteration made in the displacement. Hence, the pain caused by attempting reduction was not the feature which prevented a favourable result.

As regards the other treatment adopted in these cases, a more careful analysis must be made. In the *first series of cases*, splints were used in all the cases but Nos. 8 and 12.

In cases 1, 5, 6, 7, 9 and 11, both anterior and posterior, Carr's splints were used, the latter being kept on one week and the anterior splint three weeks.

In cases 3 and 4, the anterior and posterior splints were both kept on for ten or eleven days.

In cases 2 and 10, an anterior splint only was used; in the former case being kept on for fourteen days, and in the latter for four weeks.

In cases 8 and 12 no splints were used.

All the cases, except Nos. 4 and 11, had passive movements, from the third day or before, and massage. The massage in some was commenced from the end of the first week, but in several, as will be seen in the notes, not until after splints were removed entirely. The results in cases 4 and 11 were excellent, the movements being practically perfect, and very little deformity present.

Except in cases 2 and 5, the final result, especially as regards movement, was good, and all of these were able to continue their work with ease.

In case 2, a man aged 39, the result was bad, and the unfortunate person has been out of employment since, whereas, in case 5, limitation of extension and flexion of wrist was present fully a year afterwards. The latter was a woman aged

60, and without doubt the splints were kept on too long, even if they were to have been used at all.

Cases 8 and 12 were treated without splints, the former having passive movements from the commencement, and massage from the third day, with free use of the hand and wrist after a week, the latter having free use of the wrist from the beginning, without massage, and simply keeping a bandage round her injured wrist.

The results in these two cases were excellent, and much freer movements were obtained *earlier* than in any cases treated with splints.

Cases 2 and 8 are especially interesting for comparison, both being examples of the comminuted Y shaped fracture into the joint. The former (No. 2) was treated by attempting reduction—for what reason I cannot say, as the radiograph on admission shows very little, if any, displacement—and massage from the end of the second week. The result, as has been stated, was extremely bad. The latter (No. 8) was a similar case, treated by rest for a week with bandage and sling, passive movements from the beginning and massage from the third day, with free use of hand after a week, the final result being excellent, movements perfect, and the patient being quite able to do a day's work without discomfort.

In the second series of cases, splints were used in all but case 13, as follows:—

In cases 15, 16, 17 and 22, both anterior and posterior, Carr's splints were used, the former being removed at the end of three weeks, and the latter at the end of a week.

In case 14, both anterior and posterior splints were applied, and kept on for five weeks, which was, considering the nature of the fracture, an unreasonable time.

In case 18, the posterior splint was applied for a week, and the anterior for sixteen days.

In cases 19 and 20, the posterior splint was applied for three days only, and the anterior splint for two weeks.

In case 21, both splints were kept on for one week.

Case 13 was treated as a sprain, and free movements of wrist were indulged in from the third day.

The final result was fairly good in cases 13, 15, 16, 17, 18, 19, 20 and 22, though in some of these a certain amount of stiffness was present after three months.

The results in cases 14 and 21 were not good.

Case 21 will doubtless improve with time, but to attempt disimpaction fourteen days after the injury, and then to apply splints for one week, seems undoubtedly unjustifiable and wrong treatment.

In case 14, the injury was a partial fracture of the triangular styloid of radius, not extending into joint and without displacement. There are signs of an old impacted Colles's, which the patient states to have taken place 24 years previously. Why this case was put up in splints at all I cannot imagine, and why for five weeks is beyond comprehension.

Four months after the injury the patient is quite incapable of working, and all his movements are greatly limited. Though he has been having massage from the fourth week, it seems that both passive movements and massage should have been commenced much earlier. The result of case 13, treated without splints, was excellent, the patient being quite able to do a day's work without pain or discomfort before the end of five weeks.

As regards deformity, there was some slight deformity in all, generally the protrusion of the lower end of the ulna, due to radial displacement of the carpal fragment, though from the radiographs this seemed in many cases to be but slight.

Summarising, it will be seen that in all the three cases treated without splints, though a certain deformity remained, the movements were all perfect in a minimum of time; whereas, in the cases in which splints were applied, though in many of these excellent results were finally obtained, a much longer period of time was required in order to produce an efficient wrist, and the deformity present in these latter was just as marked as in the former. No doubt this difference in time is partially accounted for by the fact that passive movements and massage were commenced from the beginning in the cases treated without immobilization; whereas, some time, often two or three weeks, elapsed before massage was commenced in the cases treated with the aid of splints.

In discussing the treatment of Colles's Fracture, there are certain points which practically all the leading authorities are agreed:—

- (1) That active movements of the fingers should be practised from the beginning, and that any method which in any way hampers these movements should not be used. Consequently, all such splints as the Pistol splint, Gordon's splint, and such methods as Schede's and Roser's, are things of the past, and likely to cause more harm than good.
- (2) That passive movements should be practised as early as possible, at any rate from the third day, and massage always from at least the end of the first week.

The points on which authorities differ lie in the following questions:—

- (1) Whether disimpaction should be attempted or not?
- (2) Whether splints should be applied or not?

As to the first question, it has practically been answered by the results of radiography, and from the cases quoted one is bound to maintain that in the impacted fractures, except in cases of marked displacement, reduction should not be attempted. The older the patient the more is this true, for if reduction is attempted the displacement will almost certainly return, unless some means be taken to maintain the new position. The means would naturally be splints, and some advocate pads, dorsal and anterior, over the seat of the fracture; but undoubtedly the use of pads is dangerous to the fulfilment of perfect use in the injured wrist, and is to be avoided in all cases however they may be otherwise treated. Splints also are to be especially avoided in the aged, on account of the greater risk there is of causing permanent stiffening and limitation of movements (*vide* cases 14 and 18), and whilst probably not bestowing much benefit on the younger subjects, unless disimpaction has effected and the displacement improved, which, as has been pointed out, is so seldom successful, will not, provided such cases are not kept on splints longer than ten or eleven days, with passive movement and massage commenced early and continued, do much harm.

Hence, in all patients over 50, whatever the nature of the fracture, it is advisable not to apply splints; and, further, just as good a final result is obtained, and certainly a quicker one, in those younger subjects with impacted fractures without marked displacement. Mr. Hutchinson, Senr., states that, after duly warning the patient that some deformity may exist, it is perfectly safe to follow on these lines in the treatment of these cases. Certainly the patient should be warned as to possible deformity, whether he be treated by immobilization or otherwise, for in my cases just as much deformity resulted in one class as in the other. The arguments advocated by the holders of the "non-splint" theory are all upheld by my investigations, though I think that those of them who go so far as to maintain that splints are never useful must hold those views from not having seen a sufficient variable number and forms of the injury.

A badly comminuted fracture, for example (*vide* case 3), will certainly do better with rest for a week or ten days (passive movements and massage of course being applied), and such rest cannot be ensured in the class of patient met with in hospital, and but seldom in private patients, without the use

of some form of immobilization. If one could be certain that the patient would rest the limb absolutely for this period, except of course when passive movements were being performed, doubtless just as good a result could be obtained without the application of a splint as with such application; but, unfortunately, the day has not yet arrived when one can have such confidence in the majority of one's patients.

Most of the Colles's Fractures in the London Hospital are treated by the Senior Dresser, and though but few of them are bold enough to treat the condition entirely without splints, it is extremely interesting to observe that the time they keep the splint or splints applied gradually gets less and less with each patient as their appointment draws to an end and their experience grows; and, further, one almost invariably finds that those who are treated towards the end of the term of appointment of each recovers good use and excellent movement much earlier than those on whom the splints are kept applied for the longer period.

The badly comminuted fractures, or fractures with marked displacement, in which there is a possibility and also every probability of considerable improvement by attempting reduction, are essentially the cases for immobilization, and, having decided to adopt this method in such cases, it remains to choose the method of disimpaction and the variety of splint to use.

Regarding the method of attempting reduction, extension by means of the hand in a straight line is always sufficient if such reduction is possible, and the methods described by Helferich are really only slight modifications of this, requiring more assistance and possessing no material advantages.

The splints which are generally used at the "London" for treating these cases consist of the following:—

- (1) Carr's anterior and posterior splints.
- (2) Carr's anterior splint alone.
- (3) Carr's splint anteriorly and Gooch's splinting posteriorly.
- (4) Simple anterior and posterior splints as recommended by Cheyne.
- (5) An anterior splint up to the wrist with the hand fully flexed over its edge.
- (6) Plaster of Paris splints applied in two halves as recommended by Stimson.

Provided it has been decided to use the splint method, it matters but little which of these are applied. In all the fingers are free, and they each are easily removed for early passive movements and massage.

The posterior splint, if used at all, should never be kept on longer than from five to seven days,

and the anterior should also be removed from ten to fourteen days.

In the treatment of this injury, Stimson lays down the following facts to be borne in mind:—

- (1) That dorsal prominence of the fragment is to be prevented by correction of the displacement before the application of a dressing, and its recurrence prevented by direct action upon the fragment, not by indirect action through the head.
- (2) That some permanent shortening of the radius—especially on its outer side if its cancellous tissue has been crushed, as is the rule in the old and frequent in others—is inevitable.
- (3) That the prominence of the ulna can be prevented only by bringing the fragment of the radius (and thus the carpus) fully back to its normal position—a practical impossibility in many cases. Direct lateral pressure upon the sides of the wrist may diminish the prominence in some cases.
- (4) That the fingers must be left free in order to avoid the stiffening caused by this confinement.

Most authorities will agree with 2 and 4, but, as I have pointed out, the correction of the displacement mentioned in 1 generally cannot be obtained, and, still further, if so obtained, its recurrence, at any rate to some extent, cannot be prevented. The prevention of deformity, described in case 3, he owns to be impossible in many cases, but from my results it seems practically impossible to prevent in almost, if not all such cases.

Unfortunately, the method of treating the injury by a simple anterior splint up to the end of the wrist, with the hand flexed over the edge and in its proper position, was not used in any of my cases, but excellent results have been obtained by this means. Massage is generally commenced after twenty-four hours, and the splint is never kept on longer than ten days. Several cases I saw from another Hospital were treated in this way, and, clinically, there seemed to be but little deformity, with excellent movements; but I have not included these cases, as I was unable to procure radiographs before any treatment was commenced.

Several of my own cases I wished to include have unfortunately left the addresses they gave me, and ceased attending the Hospital without informing me of their new abode. All attempts to trace such, both by letter and visits, having failed, I have not included them in the series.

SUMMARY AND CONCLUSIONS

From the foregoing remarks and analyses one comes to the following conclusions:—

(1) That all patients, however treated, should be instructed to use their fingers from the beginning, and that passive movements and massage should be commenced as early as possible, the former never later than the third day, and the latter never later than one week from the date of the accident. All patients should be warned that some slight deformity may persist, but that this deformity, provided suitable treatment is adopted, is not likely to cause them any inconvenience in the movements and future use of the hand and wrists. Consequently, all such splints as Gordon's, the Pistol, etc., which hamper movements of fingers, are always to be avoided.

(2) That manipulation in *the majority* of cases has absolutely no effect on the position of the fragments. In a few cases, where the displacement is marked, a slight improvement (as demonstrated by both skiagrams and by attempted reduction under the X-ray screen) may be obtained by manipulation; but, even in these, radiographs taken at a subsequent date usually show but little difference in the final relative positions of the fragments from their position immediately after the accident. In most of the cases where improvement has been obtained, further skiagrams show that, even with immobilization, this improvement is not fully maintained when extension is relaxed.

(3) That a good deal of the deformity seen clinically soon after the injury is due to swelling of the soft parts, and that displacement, as demonstrated by radiographs, is seldom as great as one would imagine from a clinical examination. Practically, all the cases have some degree of impaction, which renders crepitus and abnormal mobility most unlikely, and generally impossible to obtain.

(4) That just as good results can be obtained in the majority of cases in persons over 50 without immobilization, and it is desirable not to use splints in these cases, but to rest the bandaged limb in a sling for a few days, and then to allow free movements, passive movements and massage both being commenced as early as possible. This treatment is desirable in these cases for several reasons:—

- (a) To avoid any chance of subsequent stiffening or hampered movements;
- (b) Elderly people so often complain that they are unable to bear the pain which immobilization so often causes;
- (c) That, as a rule, no greater deformity exists in cases treated this way than in those in which splints have been used.

(5) That in those who are younger, also where there is slight impaction and not much displacement, it is advisable not to attempt reduction nor to immobilize the limb. Some slight deformity may exist, generally protrusion of the lower end of the ulna, due to the radial displacement of the carpal fragment, even when radiographs show this to be but slight, but this deformity is not greater in this type of case treated by this method than in those of the same type treated by immobilization. In some of these cases, which are treated with splints, early passive movements and massage, the final result may be as good, but a longer time is necessary in order to obtain movements of the wrist equal to those obtained by the other method in a much shorter period.

(6) That in badly comminuted fractures, or the Y shaped fracture into the wrist joint in subjects under 30–35, it is advisable to keep the hand at rest for the first week or ten days, but never longer. As a rule, especially in Hospital patients, one cannot guarantee this without the use of some splint. During this period the patient should be seen at least four times, the splints removed and passive movements carefully performed, together with massage after five or six days. Here again, though good results are sometimes obtained in cases where the anterior splint is kept on longer, provided passive movements and massage are commenced early, they naturally require a longer period in which to recover good use and free movements of the wrist and hand. The splint should be well padded, but special pads should never be used.

(7) That the holders of the “non-splint” theory, who maintain that movements are never perfect in cases where splints have been used, carry the matter too far, for quite good results are obtained by the latter method, provided always the patients are frequently seen during the time the splints are applied, and that passive movements and massage are thoroughly and regularly applied.

(8) That, if possible, a skiagram should be taken in every case before any treatment is adopted. If attempted reduction is decided upon, an anæsthetic should be given, and another radiograph taken some days to a week afterwards. The displacement not being due to muscular action, the anæsthetic only helps in reduction in so far as it may relieve the pain the patient would otherwise be subjected to. In all cases the patient's social position and occupation should be enquired into before determining treatment.

(9) That if “attempted reduction” and immobilization are decided upon, the method of reduction by extension of the hand in a straight line is easier to perform and requires less assistance than the slightly more complicated methods of Helferich.

(10) That in cases where the styloid process of the ulna is fractured, it seldom unites, but practically never causes any inconvenience to the patient, and may be left alone.

APPENDIX

Part I. A series of skiagrams, with notes, illustrating the common varieties of the fracture, together with the chief complications met.

Part II. A series of cases, with notes, treatment, results and radiographs taken before treatment, and also radiographs taken at some period subsequently.

Part III. A series of cases, with notes, treatment, results and radiographs taken before treatment, again two or three weeks afterwards, and, finally, from two to three months after the accident.

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